A PROFILE OF ABDOMINAL VISCERAL INJURIES

[An analytical study of 44 cases]

Dissertation submitted

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CERTIFICATE

Certified that this is the bonafide dissertation done by **Dr. K.Balamurugan** and submitted in partial fulfillment of the requirements for the Degree of M.S. General Surgery, Branch -I of the Tamil Nadu Dr. M.G.R. Medical University.

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DECLARATION

I solemnly declare that the dissertation titled **"A STUDY OF ABDOMINAL VISCERAL INJURIES"** was done by me at **Coimbatore Medical College and Hospital, Coimbatore**, during the period of May 2004 to March 2006 under the guidance and supervision of **Prof. Dr. R.Perumal Rajan,** M.S.

The dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfillment of the requirement for the award of **M.S. DEGREE BRANCH – I IN GENERAL SURGERY.**

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CONTENTS

1. INTRODUCTION

Major trauma due to motor vehicle accidents, industrial accidents and Civilian violence is the commonest cause of Mortality and Morbidity in young adults. Blunt abdominal trauma is usually associated with multisystem injury which may include head, thoracic or limb injury. In penetrating trauma the most common findings are major intra-abdominal vascular trauma leading to hypovolemic shock or septic complications following disruption of solid organs and injury to the bowel. Both blunt and penetrating injury may cause damage to solid and hollow viscera within the peritoneal cavity or to the blood vessels within the mesentery or retroperitoneal tissues.

2. AIMS AND OBJECTIVES

1. The aims of this study are, to study the pattern of injury to the abdominal viscera in civilian accidents during a particular period of time i.e., from 2003-2006.
2. To study the incidence and prevalence of the various organ injuries during the same period of time.
3. To study the modalities of diagnosis and treatment for the same.

4. To grade and classify severity of various abdominal organs according to injury severity score.
5. To evaluate, simple, cost effective, and easy to perform bedside tests in the diagnosis of serious life threatening internal organ injuries and statistically evaluate them.
6. This work reviews the mechanism of abdominal trauma, the recognitions of important diagnostic features of significant injury and the optimal management of selected injuries to individual organs.
7. Important principles in the management of these complex injuries are reviewed.
8. Application of sound surgical principles to the management of abdominal trauma should decrease the incidence of unnecessary deaths when major lesions remain undiagnosed or untreated.
9. Appropriate immediate resuscitation, diagnosis and management should also reduce the incidence of post injury septicemia, pulmonary insufficiency, renal failure and malnutrition.

3. REVIEW OF LITERATURE

3.1. MECHANISM OF INJURY

Trauma patients may suffer injuries that are rapidly fatal or may cause remarkably little tissue destruction of hemodynamic instability. The former group have injuries that are not amenable to treatment and death ensues within minutes. The latter group requires careful assessment and observation and may require minimal attention to soft tissue injuries, but usually, if they remain stable, may be discharged from hospital within several hours. In between these two extremes, which accounts for 50-80% of all trauma admissions, there is a group of potentially salvageable unstable victims whose injuries are life threatening if not given urgent medical attention. These patients benefit most from rapid transportation to a hospital that provides facilities and personnel to cope with the spectrum of injuries. That is within the golden hour (TRIAGE). Among trauma patients one fifth of the deaths are due to blunt or penetrating abdominal injuries. Therefore it is particularly important to suspect abdominal injuries in this group of unstable patients.

3.2. BLUNT TRAUMA

Blunt Trauma is the most common cause of abdominal injury and is likely to be associated with multi-system injury. This often makes initial assessment difficult and may present conflicts concerning the priorities of treatment. The cause of blunt trauma are motor vehicle, auto pedestrian and industrial accidents are well as sporting injuries.

In blunt injury abdomen

The mechanism of injury May be

a. Direct Impact
b. Rapid deceleration
c. Shearing or rotational forces.

All these factors may be operative at the same time during an accident. In deceleration injuries head-on collisions or fall from a height the vessels and tissues of solid and hollow organs are torn from their attachments. Rotational forces cause similar injuries at the juxtaposition of relatively fixed and mobile structures. Whereas shearing and crushing forces may compromise blood supply to organs and cause massive soft tissue injury to anterior and posterior abdominal wall. Bursting of the bowel may also occur when intra luminal and intra-abdominal pressure rises rapidly at the moment of impact. The abdominal organs most commonly involved in blunt trauma are the spleen, liver and kidney and the most common manifestation is intra peritoneal bleeding and retro-peritoneal hematoma.

3.3. PENETRATING TRAUMA

Penetrating trauma occurs very often due to violence in this part of the country. Whereas in North India it is due to gun shot and bomb blast, in south India it is more due to knife injuries. Knife wounds acquire priority especially when intra

abdominal visceral injuries are associated with thoracic or mediastinal injuries. Gunshot wounds are more serious and produce varying degrees of injury and tissue destruction depending on the type of weapon, the velocity of the bullet and the distance between assailant and victim (Barach et al 1986[1]). Handguns fire bullets at a low velocity and produce less injury to tissue than magnum weapons, paramilitary firearms and shotguns which use high velocity ammunition and whose energy is dissipated over a wider area producing cavitations and destruction. Injuries may involve several organs and massive soft tissue necrosis. Whereas a selective policy of operative management may be appropriate for knife wounds that penetrate the peritoneal cavity, all gunshot wounds should be explored. Extensive injuries due to bombs and explosive devices may cause a combination of penetrating and blunt injury resulting in massive soft tissue injury, blast effect and loss of life and limb. Survivors all need exploration of the peritoneal cavity and extensive debridement of necrotic tissue and removal of foreign bodies. This pattern of organ injury is more common than solid organ injury and major vessels injury is more likely to occur.

3.1. INITIAL ASSESMENT AND RESUSCITATION

The patient should be admitted to the accident and emergency ward, equipped with all that is necessary for ventilatory support, monitoring, venous access and diagnostic evaluation, as well as with resuscitation fluids. Physical examination and resuscitation should proceed simultaneously and external evidence of trauma such as penetrating wounds, soft tissue injury, limb deformity, hematoma formation and bruising noted. The initial examination should include rapid assessment of the chest, abdomen and neurological status together with pulse and blood pressure, and should take less than 60 seconds. The immediate priority in management should be to establish and maintain an adequate airway and respiratory effort. In the conscious, spontaneously breathing patient oxygen may be

given by mask but the unconscious patient may require an oropharyngeal airway or endotracheal intubation and mechanical ventilation using a bag and mask or ventilator. The airway should be cleared of blood, saliva, and foreign bodies. The air entry into each lung should be checked by auscultation.

The next priority is the cardiovascular system, the blood pressure and pulse being noted along with the presence of peripheral vasoconstriction and skin temperature. Signs of hypovolemic shock should be treated by immediate insertion of large bore intravenous cannulae into uninjured limbs either percutaneously or by venous cutdown into the cubital fossa or groin. Isotonic saline should be infused rapidly (up to 21) following by the use of colloid infusion of blood plasma, albumin, dextrans or gelatin solutions (Rowlands 1988[2]). Intra-abdominal injury should be suspected in any patient who is unconscious, has respiratory difficulty and evidence of hypovolemia.

3.5. EXAMINATION

After initial airway clearance and fluid resuscitation, a more thorough examination may be carried out particularly of the chest and abdomen. The chest wall is examined for movement, evidence of fractured ribs, bruising and penetrating injury. A chest X-ray should be taken and pneumothorax or Hemothorax treated with tube thoracostomy to the affected side. The abdomen should be examined carefully and the patient 'log-rolled' to examine the back

and flanks. Palpation may reveal abdominal distention and voluntary guarding in the conscious patient, and evidence of penetration, bruising and hematoma formation on the anterior abdominal wall and flanks is noted. The pelvis is compressed to assess pelvic stability and possible fracture and the external genitalia and rectum are examined for blood and pelvic hematoma. Penetrating injuries require little in the way of diagnostic skills and all injuries between the nipple and costal margins should be suspected of entering the abdominal cavity. Blunt injury may require further diagnostic tests, if the patient is stable,

to ascertain the extent and nature of the injuries. 20% of head injured patients have associated abdominal trauma, so that hypotension in this group of patients should arouse a high index of suspicion of unrevealed hemorrhage in the abdominal or thoracic cavities. (Vanwageoner FH 1961[3])

3.6. INVESTIGATIONS

Initial laboratory evaluation should include blood for typing and cross-matching, Haematocrit, white blood cell count, electrolytes and urea, amylase, toxic substances and arterial blood gases. Abdominal X - ray gives little information apart from location of bullet fragments in gunshot wounds and bony injury to the spine and sacrum. Pelvic films document fractures of the pelvic ring. Urine analysis may reveal haematuria and intravenous pyelogram should be performed when haematuria is present to assess excretion from both kidneys and ureters. This is also essential in any penetrating injury that may involve the urinary tract. A urinary catheter should be inserted to monitor urinary output and assess effectiveness of resuscitation provided urethral injury is not suspected.

The most useful diagnostic procedure for suspected Intra abdominal visceral injury is Diagnostic peritoneal lavage (Fischer et al 1978[4]). Which is replaced by USG (**FAST** – **F**ocused **A**ssessment with **S**onography for **T**rauma).

Fast is used as a screening test for patients with blunt abdominal injury with selective use of CT or DPL based on the FAST results and the patients clinical presentation. (Bernard et al 1999[5]). Complete FAST[6] Examination consists of Imaging of the 4 P's.

1. Morrison's pouch (Perihepatic)
2. Pouch of Douglas (Pelvic)
3. Peri-splenic
4. Pericardium

USG examination included specific organs imaging with results that demonstrated 90% sensitivity and 99.5% specificity.

Other useful radiological examinations are the CT scan of the head in neurological trauma, associated with abdominal trauma in a hemodynamically stable patient to establish treatment priorities, arteriography when intravenous pyelogram (IVP) shows no function in one kidney and abdominal aortic injury or visceral artery injury is suspected and in selected pelvic fractures. Abdominal CT scanning, ultrasound, nuclear scans and laparoscopy have also been used to further define the extent of blunt injuries to thoracic and abdominal viscera.

The CT Scan has the following advantages:

1. Diagnosis and gradation of solid organ injuries such as spleen, kidney, liver etc can be made out and treatment planned accordingly.
2. CT Scan has proved to be highly sensitive and specific for abdominal injuries following blunt trauma (Tan WW et al.,1991[7]).
3. CT Scan is a valuable screening for abdominal injury in a stable patient thereby reducing the number of unnecessary laparotomies.

The following are the disadvantages of C.T.Scan.

1. It is a time consuming procedure and of questionable value in a critically ill patient, where time factor is most important.
2. It is reader dependent and availability of expert hands is not always possible during odd timings and is not feasible at all times of the day.
3. Attempting a CT in an unstable patient is increasing the danger of the delays of treatment.

During initial resuscitation and evaluation, an estimate of the severity of injury may be obtained by using one of the trauma scoring systems. These readily identify the patient who has fatal injuries, those most likely to make an uneventful and full recovery (Champion et al 1983[8]). The Glasgow Coma Scale gives an assessment of the level of consciousness, motor and verbal response and when combined with the

systolic blood pressure and respiratory rate can be used to generate the Revised Trauma Score. These simple observations, together with consideration of mechanism of injury, environmental factors and the anatomical features of the injury, readily identify the most seriously injured and provide guidelines for triage and management priorities. Other scoring systems such as the Injury Severity Score (Baker et al 1974[9]) and the Penetration Abdominal Trauma Index (Moore et al 1981[10]) require full assessment of the anatomical disruption caused by injury and are, therefore, not useful in the initial assessment. They do however correlate well with survival and development of complications and so are useful in audit of management.

Table 2
Computation of Revised Trauma Score (Champion HR 1989[11])

Glasgow Coma Scale (A)	**Systolic Blood pressure (B)**	**Respiratory Rate (C)**	**Coded Value (D)**
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	-5	1
3	0	0	0

Total coded value A+B+C= Revised trauma score.

Factors suggested high probability of multiple injuries, including significant abdominal injury. (Frank R Lewis[12])

- Revised Trauma Score of less than 12
- Glasgow Coma Scale of less than 13 (Teasdale G.Jennet1974[13])
- Rapid deceleration injury

- High velocity penetrating injury
- Falls from 4.5 m or more
- Hostile environment - Extremes of heat or cold.
- Motor vehicle accidents involving prolonged extraction, passenger space invasion by one foot or more, ejection, death of another occupant, rollover, backward displacement from axel, or pedestrian hit at 32 km/h or more.

- Massive blunt soft tissue injury
- Combination of blunt and penetrating injury, e.g. Bomb blast.
- Cave–in injury or burial
- Penetrating trauma to lower chest, abdomen or groin to mid thigh
- Complete or partial limb paralysis.

3.7. INDICATIONS FOR SURGICAL INTERVENTION IN ABDOMINAL TRAUMA.

About 20% of patients with blunt trauma have sufficient physical signs continuing hypovolemia despite adequate resuscitation and progressive abdominal distention to warrant immediate laparotomy. In stable patients following initial resuscitation, the results of USG abdomen, peritoneal lavage, together with the results of X-ray that indicates free peritoneal air and IVP, CT Abdomen, laparoscope should guide surgical intervention. Chest X-ray that indicates free peritoneal air, diaphragmatic rupture and Intravenous pyelogram that shows intra-peritoneal bladder rupture or major kidney injury and arteriogram indicating major vessel injury should lead to urgent surgical exploration. Soft tissue injury to the anterior abdominal wall or flank indicates sufficient force to cause visceral injury.

In penetrating trauma due to stab wounds immediate laparotomy is indicated for, (Timothy 2000[14])

a) Evisceration

b) Unexplained blood loss

c) Signs of peritonitis

d) Absent bowel sounds

e) Diffuse tenderness

f) Guarding.

If the patient is stable, local exploration of the wound can be used to determine if the peritoneal cavity has been entered . Superficial wounds require no further treatment, but of peritoneal penetration is confirmed the patient should undergo USG abdomen, DPL or laparoscopy to confirm the need for laparotomy, depending on the experience of the surgeon, technical availability and supervising management. A policy of exploration of all stab wounds that penetrate the peritoneal cavity is recommended for surgeons with little experience of these injuries. Less than half the patients will have significant intraperitoneal injuries but the negative laparotomy has a low morbidity. Laparoscopy was noted to be extremely useful in determining peritoneal penetration from stabbing and gunshot wounds, and also valuable in the evaluation of the Diaphragm after penetrating injury. (Ivatury et al[15]).

Following gunshot wound (Sherman RT 1963[16] irrespective of bullet Velocity, exploration of the abdomen is mandatory as visceral injury is present in the majority of cases in which the peritoneal cavity is violated. Penetrating wounds between the nipple and costal margin should all be treated with placement of tube thoracostomy on the affected side and laparotomy because injuries to the upper abdominal viscera are common and the diaphragmatic laceration must be repaired. (Borlase BL et al[17])

3.8. Preoperative Procedures

Three procedures are mandatory. They are as follows:

1. Airway and Respiration

The chin lift, Jaw thrust orophangeal airway and appropriate use of large bore rigid suction device are all maneuvers to relief simple obstruction (Guildner cv et al[18])

The definitive airway is a tube with an inflated balloon placed in trachea and secured in place by tape or sutures. The indications for definitive airway includes apnea, inability to maintain airway, need for protection of the airway, need for hyperventilation in patients with injuries to brain and inability to maintain oxygenation with face mask. (Richord M Bell[19]).

2. The establishment of an adequate channel for volume replacement and the administration of sufficient replacement of fluids initially RL, Plasma expanders and blood to stabilize the circulation. Blood should be available in large quantities when suspecting major intra-abdominal hemorrhage. This is only exception to the rule of restoring the circulation before exploration the situation when blood loss is so rapid that it is necessary to control the site of bleeding before resuscitation can proceed. It is diagnosed by the failure of 1.5-2.0 liters of replacement fluid in 10 minutes or less to effect significant improvement in the patient's vital signs-particularly profound arterial hypotension. What is now required is a bold surgeon and a cool anesthetist willing just to put the patient to sleep while laparotomy is done through relatively bloodless tissue to control if possible, the pedicle of the bleeding viscus by finger pressure until volume can be replaced.

In all circumstances of volume replacement there should be a measure of urgency; dripping in fluid over a period of an hour or two is no way to prepare the patient. The aim is to have the patient on the operating table in the minimum of time and for this purpose rapid infusion (of the order of 1-2 liter in 10 minutes) under close observation is vastly preferable (Breant E Krantz[20]).

3. The administration of a large does of antibiotic covering both aerobic and anaerobic organisms.

Laparotomy is performed through a generous midline abdominal incision following adequate skin preparation and draping to expose the patient from the chin to the knee. This allows extension into the thorax via median sternotomy or anterolateral thoracotomy, and access to the upper leg for venous infusion; or vessel harvest if damage to major vessels is encountered. The priorities are to identify and control major sources of hemorrhage and to reduce contamination from visceral secretions by temporarily clamping or suturing injured bowel. The contents of the peritoneal cavity are systematically explored and injuries are noted. The whole length of the small and large bowel should be examined. The lesser sac is explored through the greater omentum to expose the pancreas and posterior wall of the stomach. The underside of the diaphragm is inspected along with the spleen and liver. Access to the retro peritoneal structures may be obtained by reflection of the left colon, tail of the pancreas and spleen medially gives excellent exposure of the aorta, inferior vena cava, renal vessels and left kidney (Mattox et al 1975[21]). A similar maneuver on the right side reflects the caecum, ascending colon, duodenum and head of the pancreas medially to expose the right kidney and vena cava. Access to the renal vessels may also be obtained through the base of the mesentery of the transverse colon, lateral to the ligament of Treitz and the duodeno-jejunal junction. Control of intra-abdominal arterial hemorrhage may be assisted by cross clamping the descending aorta at the hiatus or compressing the vessel against the underlying vertebral bodies.(Mullins et al[22]) Liver hemorrhage may be reduced by clamping across the porta hepatis in the free edge of the lesser omentum (Pringle's manoeuvre[23]).

The principle of management should be to stop hemorrhage, to debride devitalized tissue, to repair injuries of the bowel by suture or resection, to eliminate all foreign bodies, hematoma and intestinal contents to reduce post –operative infective complications, and to repair, if possible, all major vascular injuries. The management of injuries to individual organs is considered below, but the surgeon should quickly identify the full extent of intra abdominal damage and plan his operative strategy so that injuries are dealt with in an orderly fashion with speed and safety.

4. MANAGEMENT OF INJURIES TO INDIVIDUAL ORGANS

4.1. Diaphragm

Injuries to the diaphragm are more common following penetrating trauma than blunt trauma (Clen & Wilson[24])and laparoscopy is an excellent modality for evaluation of diaphragmatic injuries and may be repaired or may be converted to laparotomy for repair(Ivatury et al[25]). The undersurface of the diaphragm should be carefully palpated and inspected by inferior retraction of the stomach, liver and spleen. Lacerations should be repaired with interrupted, non-absorbable, mattress sutures. Large diaphragmatic defects due to blast injuries require the use of Marlex mesh to bridgethem (Fallazadeh & Mays[26]). Following repair, abdominal drainage is not required and tube thoracostomy of the affected side should be performed to drain intra thoracic fluid and to obtain full re expansion of the lung.

4.2. Stomach

The stomach is rarely injured in blunt trauma but injury is common in penetrating trauma of the upper abdomen between the xiphisternum and umbilicus that puncture muscle. The anterior and posterior walls of the stomach should be carefully inspected by taking down the greater curvature to gain access to the lesser sac Injuries may be missed in the least accessible parts of the stomach – the fundus gastro esophageal junction posteriorly and intra abdominal esophagus (Kimball I Maull et al[27]). Entrance and exit wounds must be identified. The stomach has an excellent blood supply and most simple lacerations or penetrating wounds can be closed primarily in two layers following debridement of contaminated or devitalized tissue. The stomach contents decompressed postoperatively with a nasogastric tube. If the pylorus has been seriously damaged, a pyloroplasty should be incorporated in the repair (David H.Wisner[28]) more severe trauma may require resection of the stomach wall, body or antrum.

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4.3 Duodenum

Duodenal injuries, although uncommon are associated with a high morbidity and mortality which usually related to delay in diagnosis and management with blunt trauma. Factors associated with an increase in complications include a delay in definitive operative management of more than 24 hours, defects larger than 75% of the circumference, injuries to the first and second part of the duodenum, and associated pancreatic, major vessels (Portal vein, inferior vena cava) or bile duct injury (Snyder et al 1980[29]). The duodenum must be carefully inspected by incision of the lateral peritoneum and mobilization together with head of the pancreas (Kocher's maneuver).

DUODENAL INJURY SEVERITY (AAST ORGAN INJURY SCALING)

American Association for Surgery of Trauma 1991.

GRADE	**INJURY**	DESCRIPTION

I	Hematoma Laceration	Single portion of duodenum Partial thickness only
II	Hematoma Laceration	Involving more than one part Disruption<50% circumference
III	Laceration	Disruption 50%-75% circumference of D2 Disruption 50%-100% circumference of D1,D3,D4*
IV	Laceration	Disruption >75% circumference of D2. Involving ampulla of distal CBD
V	Laceration	Massive disruption of duodeno-pancreatic complex devascularization of duodenum

*D1, D2, D3,D4: first second third, and fourth portions of the duodenum. For multiple injuries, the grade is advanced one.

From Moore EE, et al: Organ injury scaling II: Pancreas, duodenum, small bowel, colon, and rectum. J.Trauma 30:1340, 1990; with permission.

A). Simple lacerations may be sutured in two layers.

B). More extensive injuries may be managed using a variety of techniques including.

a) Closure of the injury with tube duodenostomy.

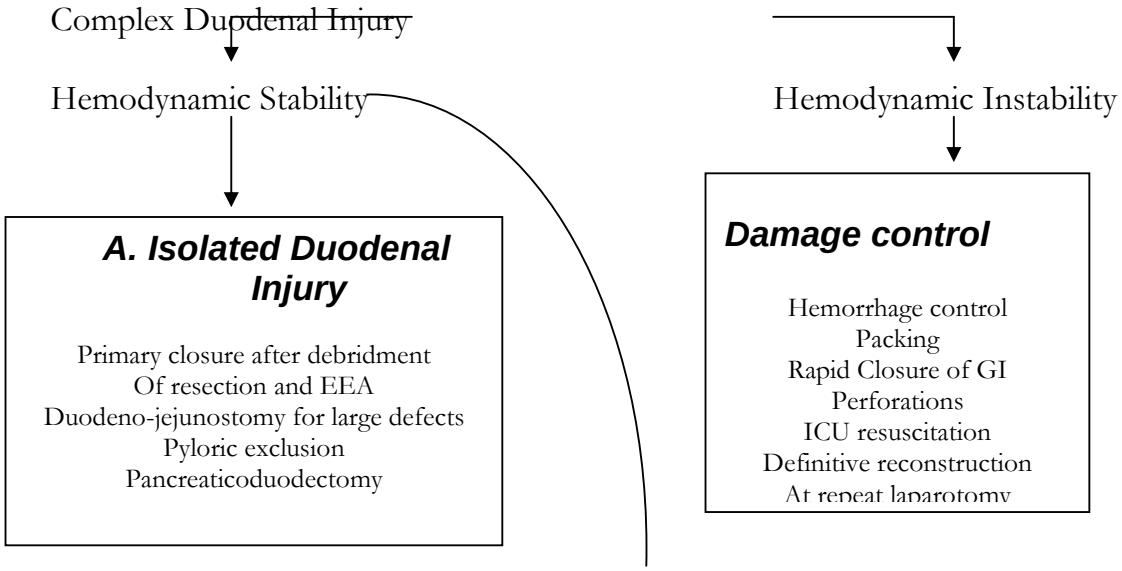
b) Decompression through a separated incision proximal to the injury.

c) Omental or serosal patch.

d) Gastroenterostomy and / or

e) Duodenal 'diverticulization' (Stone & Fabine 1979[30], Berne et al 1974[31]).

ALGORITHM FOR MANAGEMENT OF DUODENAL INJURIES[32]



B. Combined pancreatoduodenal injuries

Grade III duodenal and pancreatic injuries

Duodenal repair / resection and EEA, distal pancreatectomy, pyloric exclusion

Grades IV, V duodenal and pancreatic injuries:

Pancreaticoduodenectomy (One or two stage)

The most common complications are duodenal fistula, dehiscence of the repair and intra-abdominal sepsis which have a high mortality and, therefore, postoperative drainage of the right subhepatic region and right paracolic gutter is advocated.

4.4. Small bowel

The small bowel should be inspected at laparotomy from the ligament of Treitz to the ileocaecal valve. Injuries may consist of single or multiple perforations, lacerations to the bowel and mesentery, hematoma formation, maceration of the bowel or ischemia due to crush, blast or vascular injury.

A. Simple injuries are closed in two layers making sure that all entrance an exit wounds are identified.

B. Multiple perforations or lacerations to the bowel and mesentery are best treated with resection and primary anastomosis.

C. Non-viable bowel must be excised.

D. If there is massive intra peritoneal contamination with bowel contents or multiple associated injuries, it may be safer to defunction the bowel by constructing an ileostomy and mucous fistula (Carrilloc et al 1993[33])

E. Mesenteric hematomas are sometimes associated with perforation of the mesenteric border of the bowel.

Small bowel injuries due to blunt trauma have a greater morbidity and mortality than penetrating trauma due to the complications of associated injuries (Donohue et al 1985[34]).

4.5.Colon

Injuries to the colon are usually due to penetrating trauma and are associated with a mortality of approximately 10%. The incidence of complications and death is related to the presence of shock, the amount of intra peritoneal contamination with bowel contents, the number and type of associated injuries and the age of the patient (Burch et al 1986[35]). Controversy exists concerning the initial management of these injuries

between primary closure of the colonic wound, defunctioning colostomy and exteriorization of the repair. Most civilian injuries of the colon are due to knife wounds or low velocity bullets and many of these injuries can be treated with primary repair provided there is little or no faecal contamination, hypotension or major associated injuries. Centers with a large experience of penetrating trauma now advocate primary repair as the mainstay of treatment for colonic injury indicating that mortality is not related to type of repair and that colostomy requires a subsequent operation which may also give rise to complications (Bhurch et al 1986[36]). Several contraindications to primary closure of colonic wounds have been identified and include delay between injury and operation (within 6 hours or more), extensive peritonitis or contamination, high velocity missile wounds, blast injuries, blunt trauma producing massive body trauma and associated pancreatic and duodenal injuries (Parks 1981[37]) If resection of the right colon is necessary due to injury, primary anastomosis may be effected between the ileum and transverse colon, but injuries to the distal transverse, descending and sigmoid colon requiring resection should probably be managed by construction of a colostomy and mucous fistula, with bowel continuity being restored when the patient has recovered from his injuries (John M.Burch et al[38]) Exteriorization of a colonic repair appears to have few advocates at present and is associated with similar morbidity to colostomy and subsequent reanastomosis. The repair may break down if the exteriorized segment is not managed meticulously to avoid further tissue damage.

Colonic Injuries – Guidelines and grading of injuries and Suggested management.

Stage 1: Isolated colonic injuries with minimal contamination or blood loss, without vascular compromise of the colon, and managed within 8 hours of injury (these injuries are most suitable for primary repair)

S**tage 2:** Colonic injuries associated with other intra abdominal injuries managed within 12 hours of trauma and not associated with heavy contamination, severe blood loss, or prolonged hypotension (exteriorization – repair is general confined to this stage) .

Stage 3: Injuries that involve different segments of the colon far removed from each other or injuries associated with devascularization of the colon, severe blood loss (more than 5,000 ml of blood transfused intra operatively), prolonged hypotension (systolic BP < 80 mm Hg for more than 15 minutes), heavy fecal contamination, or a significant delay (more than 24 hours) in treatment (these wounds should routinely be managed by exteriorization as a colostomy or by primary repair and a proximal venting colostomy)

4.6. Rectum

All injuries of the rectum must be treated with[39]

a) Diversion of the faecal stream.
b) Repair of the injury.
c) Drainage of the presacral space and
d) Irrigation of the distal segment of the bowel to remove all faecal material.

These injuries are associated with a high incidence of septic Complications. An end colostomy should be constructed in the left iliac fossa and a mucous fistula brought separately on to the abdominal wall to achieve complete diversion. The rectum is repaired with interrupted sutures. Presacral penrose drains are placed via an incision posterior to the anus and by further blunt dissection between the rectum and coccyx through the levator ani (Bruch JM et al[40]) The continuity of the bowel should be restored several months after the injury when all sepsis is resolved and after radiological and functional assessment of the rectum and anal sphincters.

4.7 SOLID VISCUS

4.7.1. Spleen

The spleen is the most common solid organ to be injured in blunt trauma. It has important immunological and reticulo-endothelial functions and therefore, if injury is only minor and hemodynamically patient is stable all efforts should be made to preserve the spleen in children, adolescent and young adults. The extent of injury can only be judged by mobilization of the spleen to the midline and elevation into the wound by division of the lateral peritoneal reflection and gentle blunt dissection away from the posterior abdominal wall. The surfaces can easily be inspected following mobilization and haemostasis obtained by occluding the splenic pedicle. Superficial capsular and parenchymal lacerations may be controlled with pressure, electrocautery, suture, argon beam coagulator[41] (or) fibrin glue[42]. Deeper laceration may be treated with partial or hemi-splenectomy. When parenchymal injury is more severe or hemorrhage is not easily and quickly controlled and if there is haemodynamic instability or other associated

major injury, splenectomy is the favoured treatment. Care should be taken to ligate the splenic artery and vein separately and drainage to the tail of the pancreas or avulsion of the short splenic vessels to the greater curvature of the stomach should be avoided during removal of the spleen.

Following splenectomy, patients should be treated with antibiotics during convalescence and should be given polyvalent pneumococcal vaccine prior to discharge.

Splenorrhaphy is possible in about half the patients undergoing laparotomy for splenic trauma and splenic reimplantation may be a viable method of control of immediate hemorrhage and avoidance of the long-term sequelae of postsplenectomy sepsis (Morre et al 1984[43]).

Non operative management of splenic trauma should only be pursued if there is absolute hemodynamic stability, minimal abdominal physical indications, negative peritoneal lavage and blood transfusion requirement of less than 2 units (Macha et al 1986[44]). Grade I, II & III can be managed conservatively, Grade IV needs close observation of vital signs and serial C.T. monitoring in good setup where emergency surgery can be taken up if need arise. Grade V injury should be managed surgically. (Knudson et al 99[45]) However, laparotomy and splenorrhaphy or Splenectomy can be carried out with minimal morbidity and may return the patient to full activity soon. (Hansen VA et al; 1991[46]).

4.7.2. Liver

The liver is the most commonly injured organ following civilian trauma, and presents a spectrum of injury ranging from simple capsular avulsion or tear which requires little operative management to retrohepatic venacaval injury associated with bilobular parenchymal disruption which are often rapidly fatal. The basic principles in the management of hepatic trauma are the control of hemorrhage, removal of devitalized tissue and Perihepatic drainage. (Moore 1984[47]). The liver injury severity score, as elucidated by the American Association for Surgery in Trauma has been shown in AAST, 1991[48]

LIVER INJURY SCALE (1994 Revision)

American Association for Surgery of Trauma (AAST)

	Grade	*Injury Description*
I	Hematoma	Subcapsular, <10% Surface area
	Laceration	Capsular tear, <1cm Parenchymal depth
II	Hematoma	Subcapsular, 10%-50% surface area; Intraparenchymal depth, <10cm in length
	Laceration	1-3 cm parenchymal depth, <10cm in length
III	Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular of parenchymal hematoma Intraparenchymal hematoma >10cm or expanding
	Laceration	>3 cm Parenchymal depth
IV	Laceration	Parenchymal disruption involving 25%-75% of hepatic lobe of a 1-3 Couinaud's segments within a single lobe.
V	Laceration	Parenchymal disruption involving 25%-75% of hepatic lobe or >3Conuinaud's segments within in single lobe
	Vascular	Juxtahepatic venous injuries i.e., Retrohepatic vena cava avulsion
VI	Vascular	Hepatic avulsion

*Advance one grade for multiple injuries up to grade III.

Modified from Moore EE, Cogbill TH, Jurkovich GS, et al: Organ injury scaling: Spleen and liver (1994 revision) J.Trauma 38.323-32224, 1995; with permission.

Laparotomy should be performed through a generous midline incision and if hemoperitoneum is present and liver injury suspected, the right upper quadrant should be rapidly evacuated of blood and packed while the rest of the abdominal contents are assessed for life-threatening injury. Haemostasis may be aided by use of the Pringle maneuver to occlude the vessels in the porta hepatis and hypotension may respond to aortic occlusion at the hiatus. Grade – I to V can be managed non operatively under close observation[49].

The majority of injuries can be controlled with suture of the liver capsule, individual ligation of vessels and biliary radicals following exploration of lacerations extending into the liver parenchyma, or ligation of a branch of either the portal vein or hepatic artery supplying a segment of injured liver tissue. In less than 5% of cases will require a major procedure such as resection of a segment or hepatic lobectomy. Injuries to the vena cava and hepatic veins are unusual and have a high mortality. These procedures should not be undertaken by inexperienced surgeons, temporary packing of the liver injury and immediate transfer to a surgeon with experience of hepatic surgery is advocated. Access to the liver may be improved by extending the abdominal incision into the right chest through the right costal margin and diaphragm. Devitalized and macerated liver parenchyma should be removed.

Minimal liver injuries should not require postoperative drainage, but if there is significant parenchymal destruction or resection is carried out leaving a raw parenchymal surface then closed suction drainage should be used postoperatively for approximately 48 hours. Mortality from complex hepatic injury is about 50% and the most common cause of death is shock and transfusion coagulopathy in the

perioperative period (Feliciano et al 1986[50]). Sepsis due to intraabdominal abscess is the most common late complication.

4.7.3. Injury to the Gallbladder and Bile Ducts

On opening the abdomen, if bile is chiefly in evidence examine

(1) The gallbladder; (2) The duodenum; (3) The cystic duct;

(4) The common bile duct; and (5) The hepatic ducts. The second part of the duodenum and the head of the pancreas should be mobilized in order to facilitate inspection of the lower common bile duct and duodenum.

Rupture of the Gallbladder

If the gallbladder is found to be injured, cholecystectomy should be performed[51].

Injuries to extra hepatic bile ducts.

1. Common hepatic ducts – Roux –en-y hepatico-jejunostomy & external drainage.
2. Rupture of the cystic duct

   Clearly the treatment indicated is to ligate the stump and perform cholecystectomy.
3. Traumatic rupture of the bile ducts

This is less common than injury to the gallbladder and, unless it is associated with other grave injuries, is not rapidly fatal. Often it is the gradual distension of the abdomen with fluid and the appearance of jaundice that call attention to the condition after several days. Pyrexia, jaundice and toxemia precede a fatal termination in untreated patient. If rupture involves less than 50% primary repair[53] , Roux – en – y choledochojejunostomy, cholecystectomy and external drainage. Distal CBD injury ligature of the proximal end of the duct and cholecystojejunostomy have been recommended.

4.7.4. Pancreas

Pancreatic injury has a high associated morbidity. It may be particularly difficult to manage when penetrating injuries cause associated injury to major vessels (vena cava, portal vein, superior mesenteric vessels), the extrahepatic biliary system and the duodenum.

Important determinants of the outcome are the magnitude of associated injuries and the presence or absence of injury to the pancreatic duct or duodenum (Jones 1985[54]).

PANCREATIC INJURY SCALE

GRADE	INJURY
I	Minor contusion or laceration without ductal injury
II	Major contusion of laceration without ductal injury
III	Distal transection or parenchymal injury with ductal injury
IV	Proximal transection or injury involving duct or ampulla
V	Massive disruption of pancreatic head

From Moore EE, Cogbill TH, Malagoni MA, et al: organ injury scaling, II, Pancreas duodenum, small bowel, colon, and rectum.J.Trauma 30: 1427, 1990; with permission.

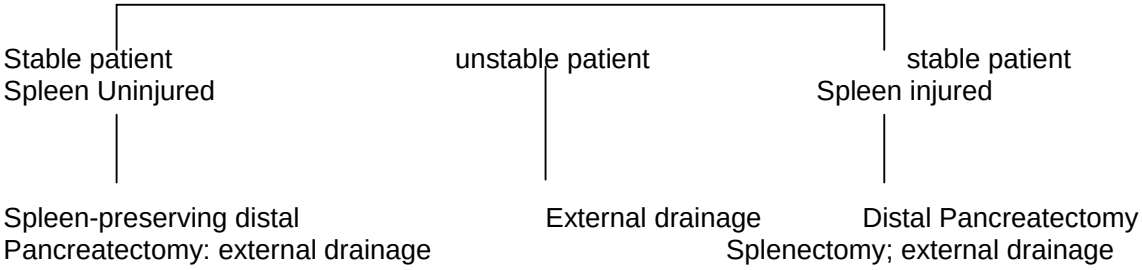
CT scan the best investigation for the detection of pancreatic injuries[55].

Injuries to the parenchyma of the pancreas should be assessed by opening the lesser sac and reflecting the hepatic flexure of the colon inferiorly to expose the head, body and tail of the pancreas. Injuries to the left of the mesenteric vessels (distal pancreas) should be treated by drainage of the lesser sac using sump or closed suction drains provided there is no associated ductal injury.

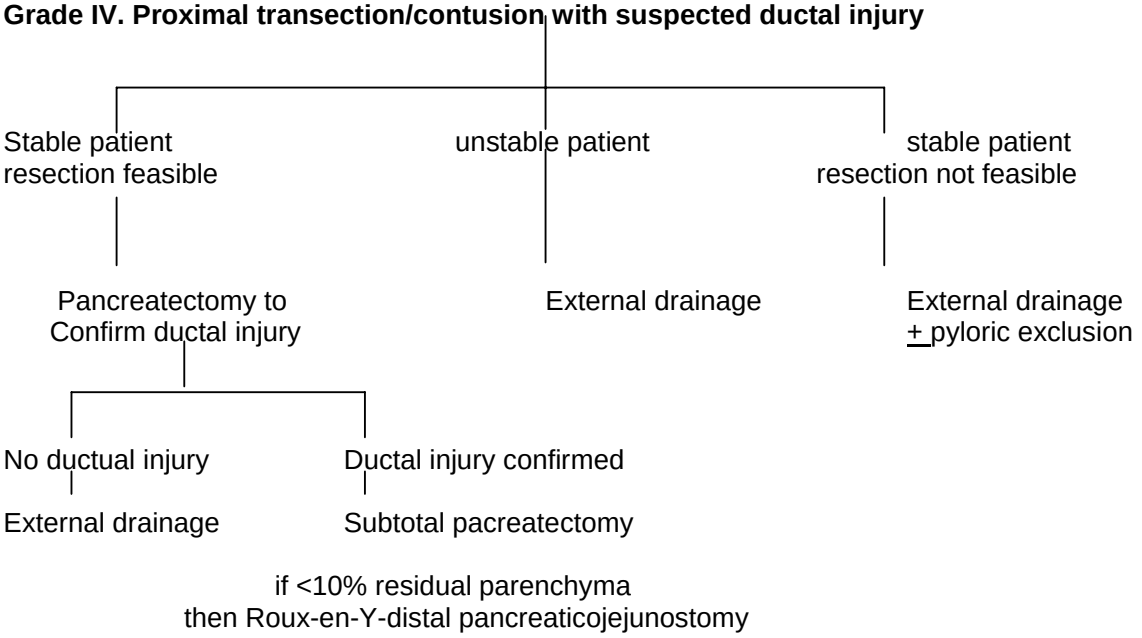
Grade I and II managed by the use of external drainage[56] .

Algorithm for injury graded Management of Complex Pancreatic Injuries[57].

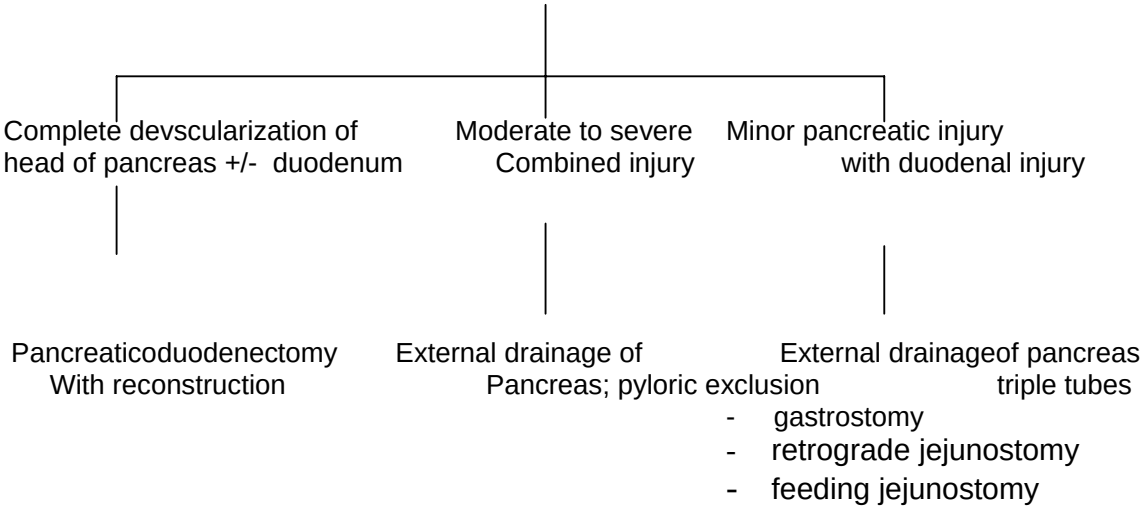
Grade III Distal transaction / parenchymal injury with suspected duct injury.



Grade IV. Proximal transection/contusion with suspected ductal injury



Grade V. Massive disruption of pancreatic head/combined pancreaticoduodenal injury



More complex injuries need an individualized approach by an experienced surgeon to assess the possibility of repair of the injury, and the use of techniques to limit complications due to anastomotic breakdown or leakage in the postoperative period (Feliciano et al 1987[58]) . Major complications in patients who survive more than 48 hours are intra-abdominal sepsis, and pancreatic fistula. Rarely is pancreaticoduodenal resection

necessary, the indications being proximal pancreatic duct, ampullary or distal bile duct injuries that preclude reconstruction and combined devascularizing injuries to the pancreas and duodenum (Oreskovich & Carrico 1984[59]) The above table gives an appropriate algorithm for the management of complex pancreatic injuries according to the grade of injury.

4.7.5 Kidney and Bladder

Blunt forces are responsible to 70 to 80%, whereas 6 to 24% penetrating abdominal wounds results in renal injury[60]. Rt renal and hepatic injuries coexist in 30% of blunt trauma and 73% penetrating trauma while left renal and spleen injuries coexist in 30% blunt trauma and 28% penetrating trauma[61].

The commonest cause of rupture of the kidney are either road accidents or Sports such as rugby football. A kidney can be damaged by a direct blow in the loin, such as when a player falls on the ball. Another form of sport in which renal damage is horse riding. When a rider is thrown and lands across the top pole of a jump, he is often falling laterally at the time of impact and it is his loin that takes the blow. A kidney is often injured indirectly by compression between the 12th rib and the vertebral column. If such compression occurs suddenly and forcefully, it can quite easily split the kidney, and this situation could arise either from a direct blow in the loin or from sudden lateral flexion of the trunk.

Though this account of pathogenesis has dealt mainly with closed injuries, open injuries are still a taxing problem. They are considered but many of the principles that follow are equally applicable to both open and closed lesions.

Organ injury scaling:

Kidney (Grade and Description)

I. Contusions: haematuria with normal urologic studies; hematoma; subcapsular,nonexpanding without parenchymal laceration.

II. Hematoma nonexpanding, perirenal hematoma confined to retroperitoneum, laceration < 1 cm parenchymal depth of renal cortex.

III. Laceration > 1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation.

IV. Laceration: parenchymal laceration extending through the renal cortex, medulla, and collecting system, vascular : main renal artery or vein with contained hemorrhage.

V. Laceration: completely shattered kidney; vascular: avulsion of renal hilum that devascularizes kidney.

Modified from Moore EE, Cogbill TH, Jurkovich GJ, et al: Organ injury scaling: Spleen and liver,kidney J Trauma 38:323, 1005, 1994.

If gross haematuria present CT scan, IVU is indicated.

Simple classification of renal injuries[62].

	Minor	*Intermediate*	*Major*
	70 – 80%	Less than 20%	5 – 10%
	Grade – I	Grade – II	Grade – III
Haemorrhage	Mild, remitting		Severe,un-Remitting
Urographic function	Delayed,Diminished		Absent
Haemodynamics	Stable,satisfactory	Laceration Extravasations	Unstable Unsatisfactory

Treatment[63]

Grade I – conservative

Grade II - Usually conservative, surgical exploration only for persistent

hemorrhage extravasations.

Grade III – Surgical Management.

INDICATIONS FOR RENAL EXPLORATION[64]

A. Patients staged with CT or angiogram

I. Blunt trauma or stab wounds

a. Continued hemorrhage

b. Large devasuclarised segment of kidney

c. Major extravasations, especially if ureter is not visualized.

II. Gunshot wounds

a. Any degree of extravasations

b. Large perinephric hematoma

c. Devasuclarised segment

B. Patients not adequately staged (intraoperative decision)

I. Blunt trauma

a. Continued hemorrhage

b. Expanding or pulsatile hematoma

c. Extravasation of urine

II. Penetrating trauma

a. Any Significant hematoma

b. Extravasation of urine

An injury is termed 'Critical' when the kidney is shattered or there may be a tear in the renal artery, or one of its branches, or complete avulsion of the major vessels. The

latter type of injury is occasionally found in association with other major abdominal injuries. Avulsion injuries are seen from gunshot wounds, which penetrate the loin and produce a disruptive effect in the region of the renal vessels.

As most of the subscapsular hemorrhage are never recognized clinically, the incidence of the various grades of injury is difficult to assess but critical injuries probably constitute no more than 2 percent. This injury is nearly always extra peritoneal. In children below the age of 10, in whom there is little if any perinephric fat, very occasionally the peritoneum is torn in addition to the renal capsule allowing blood, and perhaps urine, to escape into the peritoneum cavity.

Renal injuries are more common in injuries involving both the flanks, crush injuries, and road traffic accidents in which patient falls on his back. Renal injuries should also be suspected in stab injuries of the flank and fall from heights and in patients with retroperitoneal hematoma. Injuries to the renal pedicle often result in exsanguinating hemorrhage and gross hypotension. Parenchymal injuries should be suspected if there is haematuria. Haematuria should be investigated with intravenous pyelogram to exclude renal trauma or bladder rupture. If either kidney is not visualized, elective angiography should be carried out to assess the renal vessels and their function. CT scan remains the valuable tool in the diagnosis and gradation of kidney injuries and has a diagnostic accuracy as high as 98%[65]. The plan of exploration and management of renal trauma has been tabulated. The kidneys should be approached through a standard laparotomy with reflection of the right or left colon, but access to the aorta for control of renal vessels can be obtained through the base of the transverse mesocolon provided there is no extensive retroperitoneal hematoma. Renal salvage is possible in the majority of blunt and penetrating injuries. Injuries to the renal pedicle carry the greatest morbidity (Sagalowski et al 1983[66]). Renal ureteral injuries should usually be drained following repair. Intra peritoneal bladder ruptures can be treated with formal closure of the bladder wound and

either suprapubic or urethral drainage with little or no morbidity, whereas extraperitoneal rupture may be treated effectively with bladder drainage alone (Corriere & Sandler 1986[67]).

4.8. VASCULAR INJURY

Major hemorrhage from intra-abdominal arteries and veins are the main cause of immediate death following blunt and penetrating injury. The principles of management are as for elective vascular surgery in that proximal and distal control of the vessel is required on either side of the injury. The abdominal aorta and its branches should be approached by medial mobilization of the viscera and not by dissection through a retroperitoneal haematoma[68]. Initial control of aorta may be achieved by transthoracic approach to the descending thoracic aorta or by encircling the abdominal aorta as it passes through the hiatus and compressing against the vertebral bodies. Penetrating injury may cause entrance and exit wound in major vessels.

With arterial injury when control is obtained, the vessel should be derided to remove damaged intima and repaired by primary suture. When segment of vessels are resected inter position of graft of expanded PTFE (Polytetrafluro ethelene) or Dacron can be used[69]. Venous patch, venous on lay graft, autogenous artery graft may also be used. (Holcroft 1982[70]). Venous injuries may in general be treated by suture repair ligation of the vessel exceptions are injuries to the superior mesenteric vein and suprarenal portion of inferior vena cava. Penetrating injuries of the infra-renal portion should be treated by repair of both the posterior and anterior wall, the former being accomplished by suture inside the vessel. Attempts to mobilize or encircle the vena cava may cause damage to major lumbar veins resulting in further hemorrhage which is difficult to control. Control of inferior venacaval hemorrhage may be achieved with direct pressure on the vein above and below the injury. The use of Dacron grafts to replace arteries or veins should be avoided in the presence of significant contamination.

4.9. POST OPERATIVE CARE

The majority of deaths due to blunt or penetrating trauma occur in the 48 hours following injury. Subsequent morbidity and mortality are usually related to intra abdominal sepsis. Anastamotic breakdown, fistula formation or secondary hemorrhage. A small number of patients will require prolonged monitoring and support in an intensive care unit and some will develop multiple system organ failure (Faist et al 1983, Carrico et al 1986[71]).

Significant factors leading to multiple system organ failure are shock, massive blood transfusion and sepsis. The treatment usually consists of support or organ function and control of sepsis. The usual sequence of organ failure is the lung, clotting system, kidney and liver. Most patients with abdominal trauma should be given antibiotics as soon as possible covering both aerobic and anaerobic Organisms. The length of antibiotic therapy can subsequently be determined on the basis of operative findings. (Rowlands et al 1987[72]) . This selective approach determines that 'low' risk patients receive antibiotics in the peri-operative period and 'high' risk patients receive short term treatment for approximately 72 hours.

Determinants at Laparotomy of length of postoperative antibiotic therapy.

Continue antibiotic therapy for 72 hours.

High risk : Gastrointestinal penetration of ileum or colon.

Massive liver injury

Major pancreatic injury.

High velocity gunshot wounds

Blast injuries

Incomplete haemostasis

Presence of non-viable tissue

Foreign body contamination

Major splenic repair

Low risk : All other abdominal injuries not designated as high risk.

Additional important items of management are the prevention of prolonged hypotension, abdominal compartment syndrome, respiratory failure, renal failure and malnutrition with appropriate metabolic and nutritional support which preserves organ perfusion and cellular metabolism. (Cerra 1987[73]).

4.10. ABDOMINAL COMPARTMENT SYNDROME

The abdominal compartment syndrome (ACS) may be defined as the adverse physiologic consequences that occur as a result of an acute increase in intra – abdominal pressure (IAP). Clinically, the organ systems most affected include the cardiovascular, renal and pulmonary systems. Decreased cardiac output due to increased peripheral resistance and decreased venous return[74], oliguria, anuria, increased airway pressure, decreased compliance and hypoxia[75] may all occur. If untreated, ACS leads to lethal organ failure. In contrast, decompression of the abdominal cavity immediately reverses the above pathophysiologic changes. The most common cause of the syndrome is coagulopathy and postoperative hemorrhage. Although these may occur following any abdominal procedure, they are most often seen in trauma patients. (Burch et el, 1996[76])

1. ACS is caused by an acute increase in intra abdominal pressure, usually as a result of intra-abdominal hemorrhage.
2. The most common and significant complications are respiratory and renal failure.
3. Abdominal decompression promptly reverses the complications of ACS.
4. Failure to recognize and treat ACS inevitably fatal.

Nutritional support may be given by enteral or intravenous routes and should be started in the post injury period as soon as the patient has become hemodynamically stable with good fluid and electrolyte and acid-base balance. Protein and calories, mineral and vitamins should be given in sufficient quantities to match the increased metabolic needs associated with trauma, surgical intervention and septic complications (Rowlands and Dudrick, 1982[77]). Once recovery from the initial phase of injury is complete, prolonged convalescence and rehabilitation may be necessary to achieve full organ function.

Grading of ACS

Grade	Pressure (cm H_2O)
I	10 - 15
II	15 - 25
III	25 – 35
IV	> 35

5. MATERIALS AND METHODS

A series of 44 patients with injuries of the abdominal viscera who were admitted to the trauma ward of Coimbatore Medical College Hospital with abdominal guarding, rigidity or penetrating injuries during 2004 - 2006 were studied. Of these patients, 26

patients were admitted for blunt injury and remaining 18 cases were of penetrating abdominal injuries. All these patients were worked up diagnostically and therapeutically as emergency measure. Surgical management was on as emergency basis for indicated patients. 8 patients were managed conservatively and discharged. All the patients were worked up as follows-Blood grouping and cross matching, basic investigations, chest and abdominal radiography ; Abdominal paracentesis, USG, CT abdomen and appropriate surgical management were done as indicated. The Definitive surgical management was based on per -operative findings during surgery and planned accordingly.

OBSERVATION AND RESULTS

IN 18 CASES OF PENETRATING INJURY

Liver	3
Spleen*	3
Kidney	1
Stomach**	1
Small intestine***	10
Colon	2
Rectum	1

* Colon also involved in 1 patient

** Liver also involved in 1 patient

*** Colon also involved in 1 patient

Considering the entry wounds of penetrating injury and hemodynamic instability, 10 patients were taken for ultrasonogram. Solid organ injury were detected in 7 patients out of which 3 were splenic injuries, 3 liver injuries, 1 renal injury. All 18 were

taken for laparotomy. One patient died in Post -Operative period, who had both splenic and colon injuries.

IN 26 CASES OF BLUNT INJURY

Liver	6
Spleen*	8
Small intestine	6
Pancreas**	1
Renal ***	3
Retroperitoneal	3
Duodenum	1
Colon	2

* Small intestine perforation with 1 case

** Retroperitoneal hematoma also present in this case

*** Retroperitoneal hematoma also present in 2 cases

All the 26 patients were taken for plain X- ray abdomen. Air under the Diaphragm was seen in 5 out of 9 bowel injury cases.

Abdominal paracentesis done in 18 hemodynamically unstable Patients revealing hemoperitoneum in 10 cases which is 55 % sensitivity.

All 18 cases were taken for laparotomy had intraoperative findings Corroborating clinical suspicion.

USG was done in all 26 cases of blunt injury, showed splenic injury in 8 patients, liver injury in 6 patients and renal injury in 6 patients. The above findings were confirmed by either laparotomy or CT - Abdomen.

CT abdomen done in 10 cases, 1 case of pancreatic Injury, 2 cases of retroperitoneal hematoma and confirmed the findings of USG in remaining cases.

DISCUSSION

A series of 44 patients with abdominal visceral injuries and their treatment was undertaken in this study. 26 patients were admitted for blunt injury and 18 patients for penetrating injury.

In Penetrating injury 8 patients were taken for laparotomy immediately after resuscitation because of either Prolapse of omentum or bowel.

In Remaining 10 patients, USG abdomen was done. USG was able to diagnose all 3 splenic injuries, all 3 liver injuries and a renal injury. CT was deferred since all patients with penetrating injuries were planned for laparotomy. USG will help us to plan the surgery.

1 patient died in 3rd postoperative period due to septicemia, renal

failure. This patient had splenic laceration, fecal contamination of peritoneal cavity with partial rupture of descending colon. Splenectomy and colon injury were closed in 2 layers. Remaining all 17 patients recovered well. In 1 patient colostomy closure was done after 3 months who had rectal injury.

In blunt injury abdomen plain X-ray and USG was taken for all cases. Plain X-ray abdomen showed air under the diaphragm in 5 patients out of 9 bowel injury cases. The sensitivity of X- ray abdomen in bowel injury is 55%.

USG was done in all 26 cases of blunt injury that showed splenic injury in 8 patients, liver injury in 6 patients and renal injury in 3 patients. The above findings were confirmed by either laparotomy or CT - Abdomen. So sensitivity of USG abdomen to detect spleen, liver and renal injuries is 100% which correlates with FAST[6] which demonstrated 90% sensitivity, 99.5% specificity in solid organ injuries. One case of pancreatic injury not diagnosed by USG abdomen was diagnosed by CT abdomen. Out of the 3 cases of retroperitoneal hematoma,2 cases diagnosed by CT-Abdomen and 1 case was an intraoperative finding opened for renal injury.

CT could not be taken in view of poor general condition of this particular patient. USG abdomen done for all 3 patients did not diagnose the Retroperitoneal hematoma. In this study 3 cases of blunt injury died in the Post-operative period of which one patient had pancreatic ductal injury with Retroperitoneal hematoma died due to ARDS.The other case had liver laceration and died due to uncontrolled bleeding. The last case was of renal avulsion injury with retroperitoneal hematoma which was diagnosed Per -Operatively died due to uncontrolled bleeding.

8 cases were managed conservatively of which 5 had splenic injury, 2

had liver injury, 1 had renal injury. In all 8 cases CT -Abdomen was done which Confirmed the USG findings and to rule out other injuries so that these patients were managed conservatively. Repeat USG was done in the

Observation period. All patients recovered well.

Liver and spleen injuries are the commonest causes of Intraabdominal bleeding and so resuscitate the patient as early as possible so that patient can be taken up for surgery if necessary. Since a retrospective study of 1000 trauma deaths by Anderson[78] showed that preventable deaths were due mainly to missed intraabdominal bleeding and inadequate management. Even a negative laparotomy in patients undergoing other procedures concurrently should never be discouraged if significant intraabdominal injuries are suspected. In this series no negative laparotomy was encountered.

It has to be stressed that bedside USG evaluation of all patients with abdominal visceral injuries in the emergency department by surgeon is very much desirable and useful in order to avoid Negative Laparotomy.

CONCLUSION

1) The pattern and incidence of abdominal and visceral injuries in this geographic area was studied.

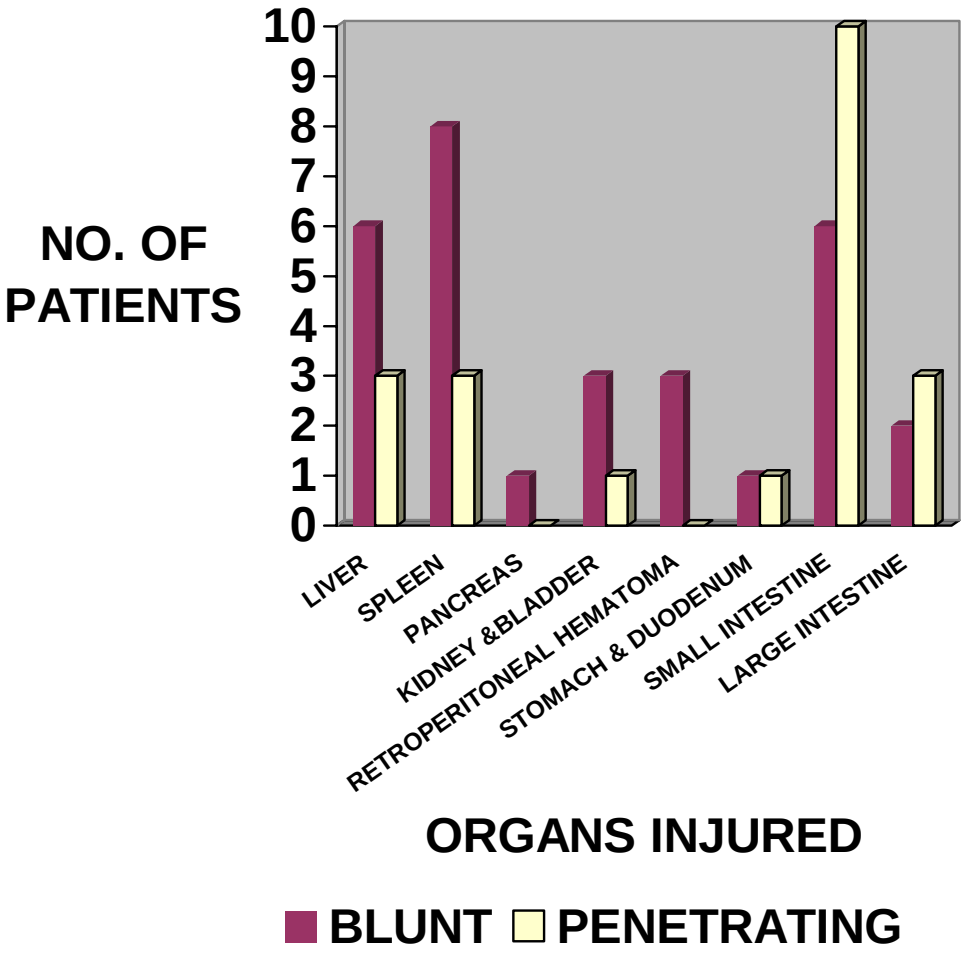
2) In this study, the commonest visceral organ injury was small intestine(16 cases) followed by spleen(11 cases).

3) In blunt abdominal injury the commonest organ injured was spleen(8 cases) and in penetrating abdominal injury the commonest organ injured was small intestine(10 cases).

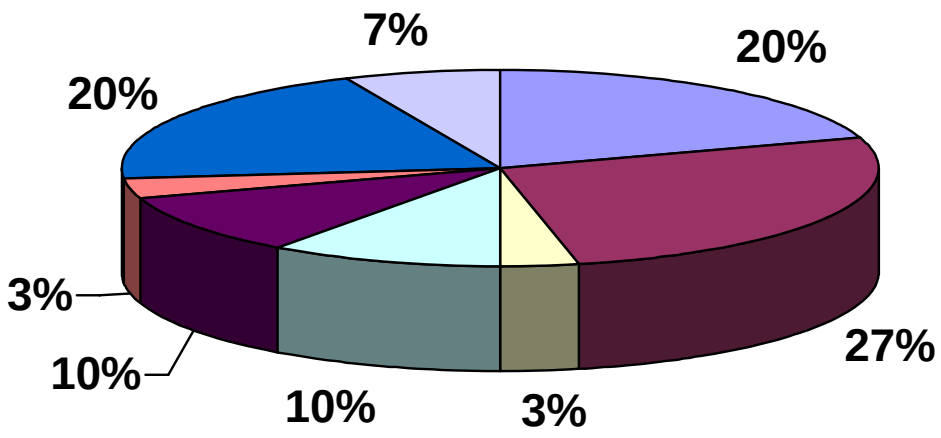
4) Emergency USG at the bed side is desirable and useful especially in blunt trauma, to plan for management in order to avoid Negative Laparotomy.

5) CT-scan was particularly useful to detect injury of pancreas and retroperitoneal injuries.

ABDOMINAL VISCERAL INJURIES IN 44 PATIENTS

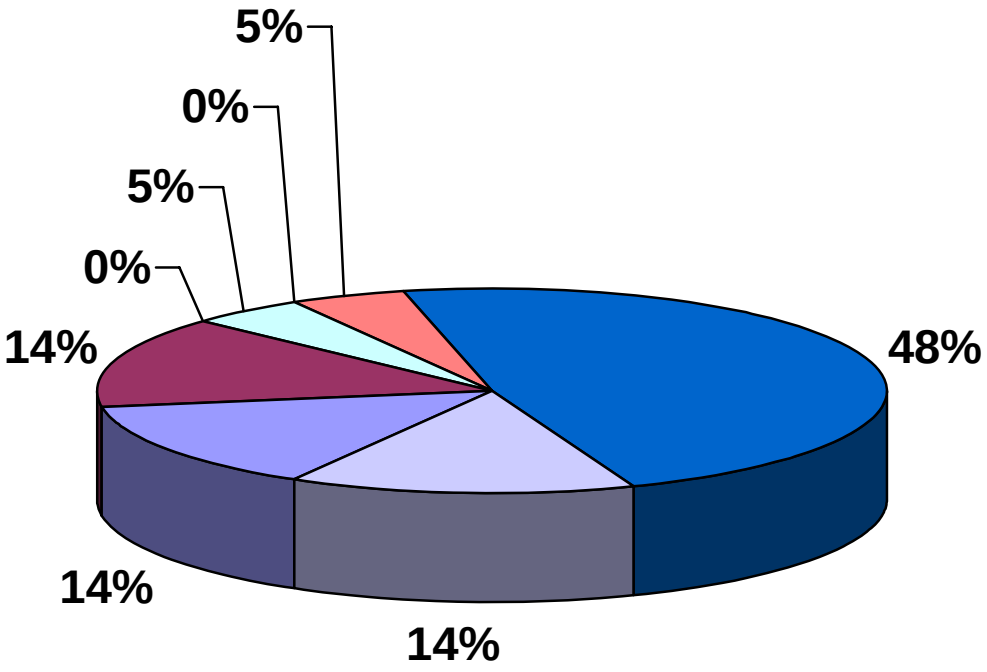


BLUNT INJURY IN 26 PATIENTS

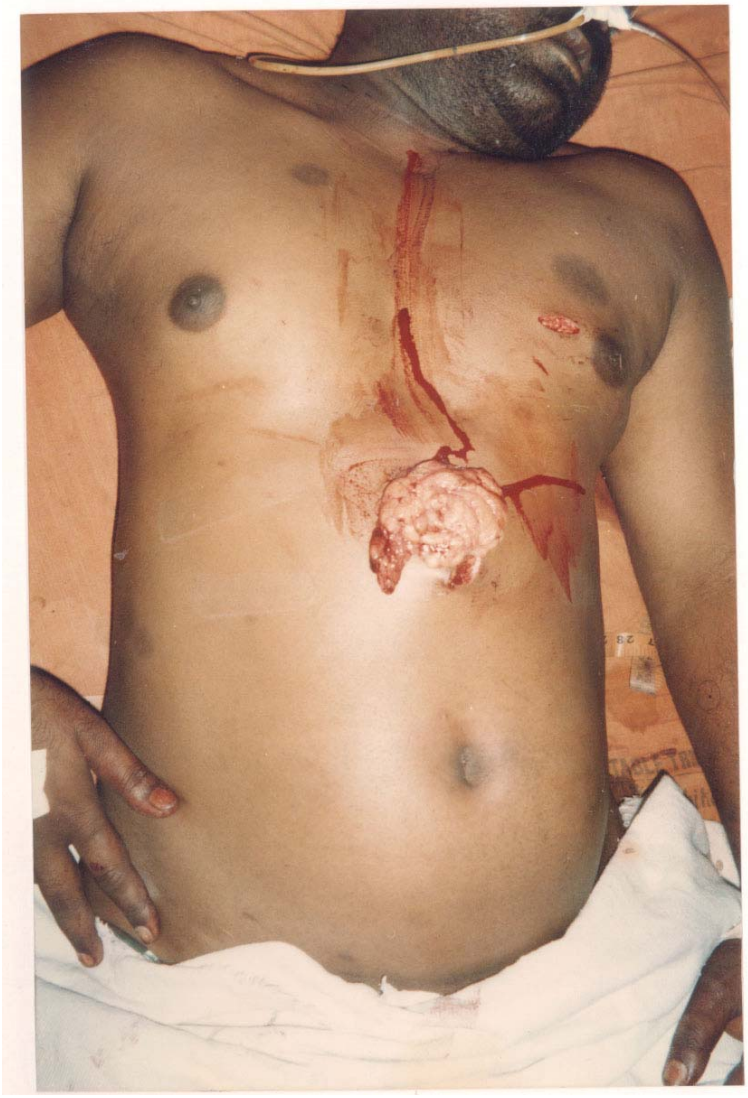


- LIVER
- SPLEEN
- PANCREAS
- KIDNEY & BLADDER
- RETROPERITONEAL HEMATOMA
- STOMACH & DUODENUM
- SMALL INTESTINE
- LARGE INTESTINE

PENETRATING INJURIES IN 18 PATIENTS



- LIVER
- SPLEEN
- PANCREAS
- KIDNEY & BLADDER
- RETROPERITONEAL HEMATOMA
- STOMACH & DUODENUM
- SMALL INTESTINE
- LARGR INTESTINE



STAB WOUND OF EPIGASTRIUM WITH

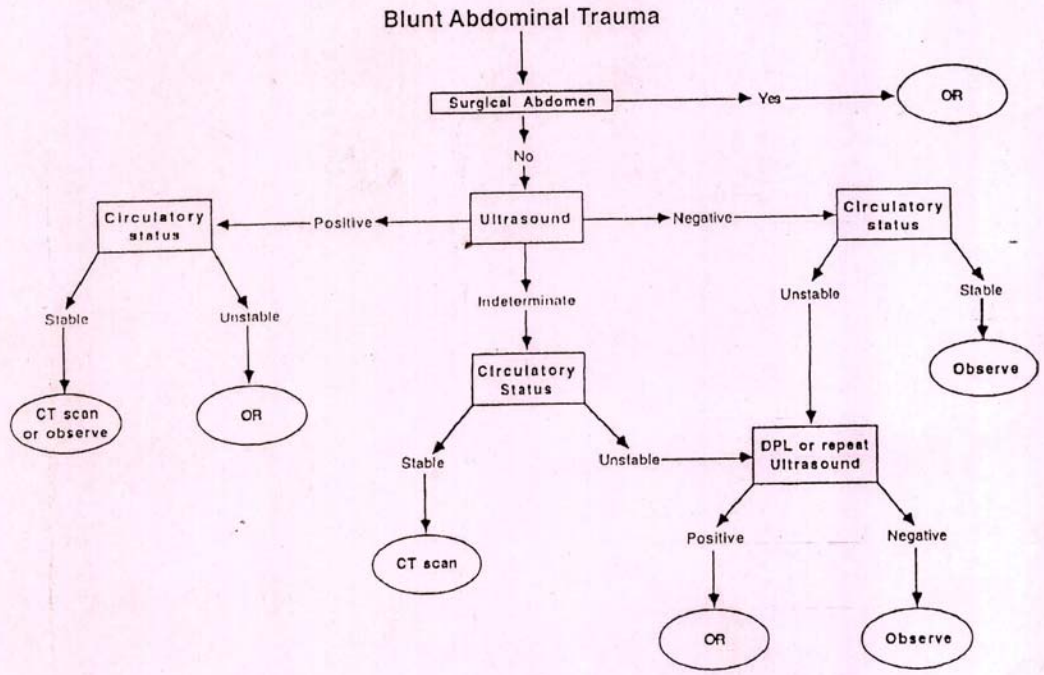
OMENTAL PROTRUSION

STAB WOUND OF UMBILICAL REGION

LOOKING APPARENTLY SIMPLE . THIS PATIENT HAD

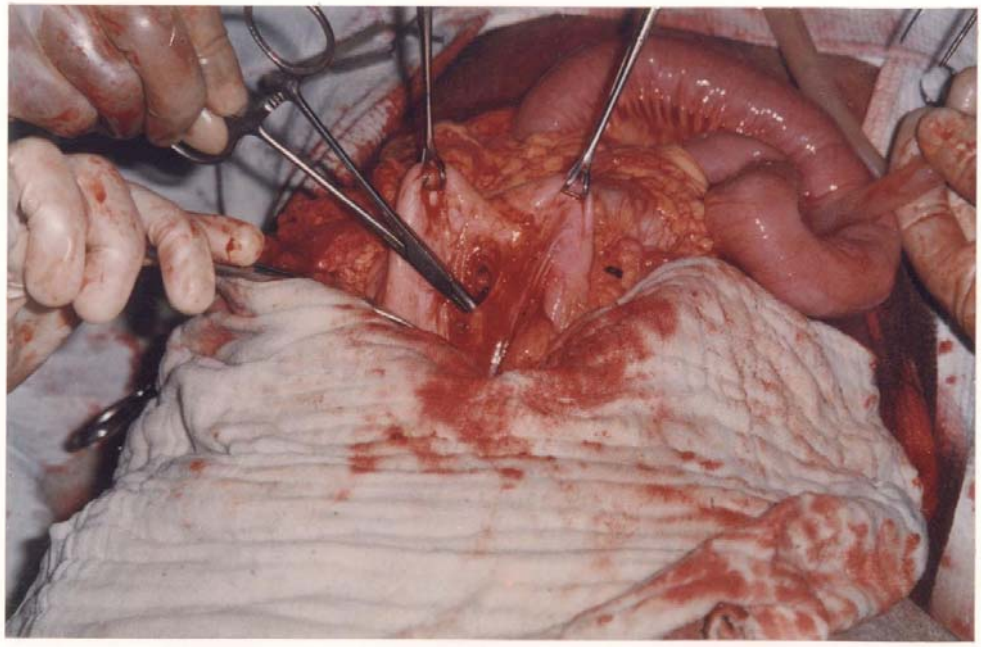
AN ILEAL PERFORATION AND TRANSVERSE COLON INJURY WITH

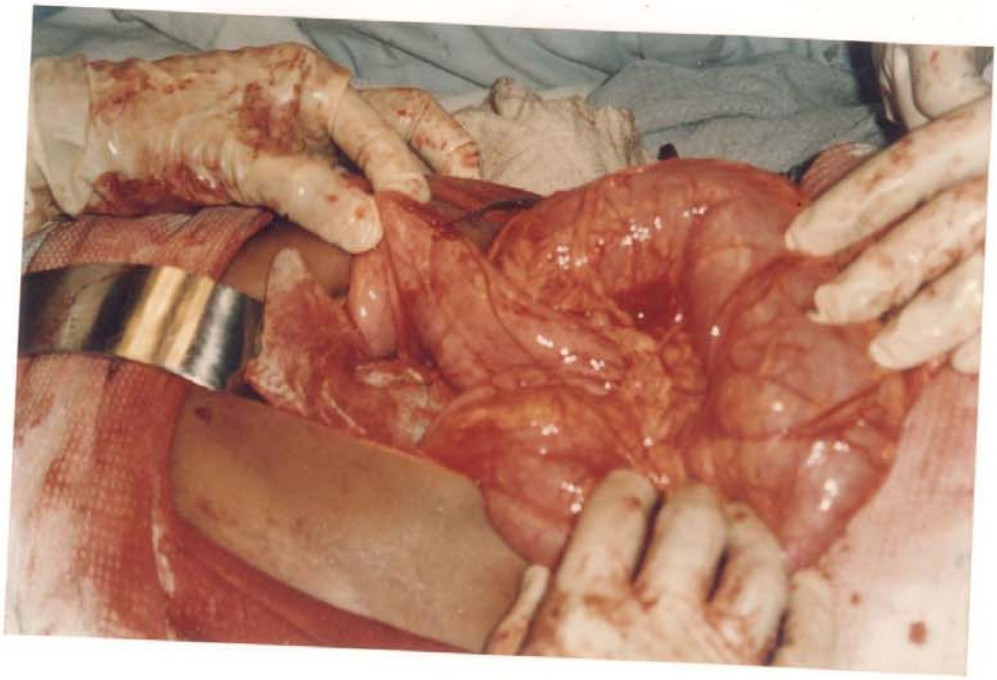
HEMOPERITONEUM



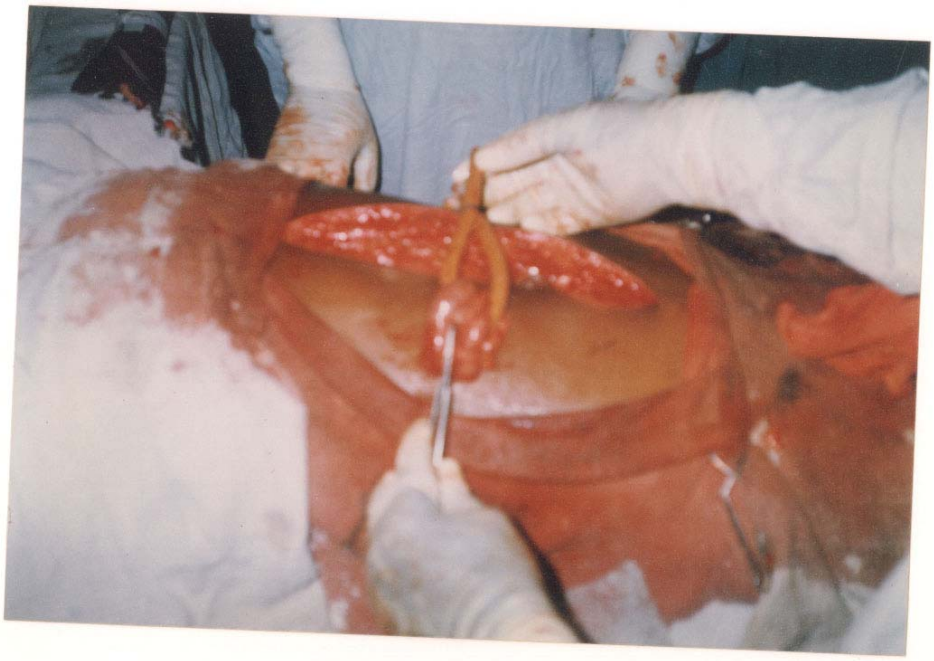
Blunt abdominal trauma. OR = operating room; DPL = diagnostic peritoneal lavage. (*From* Kearney P: University of Kentucky Trauma Protocol Manual, 1999; with permission.)

ENTRY WOUND IN A GUN SHOT INJURY.
PATIENT HAD A COLONIC TEAR AND
SPLENIC INJURY.





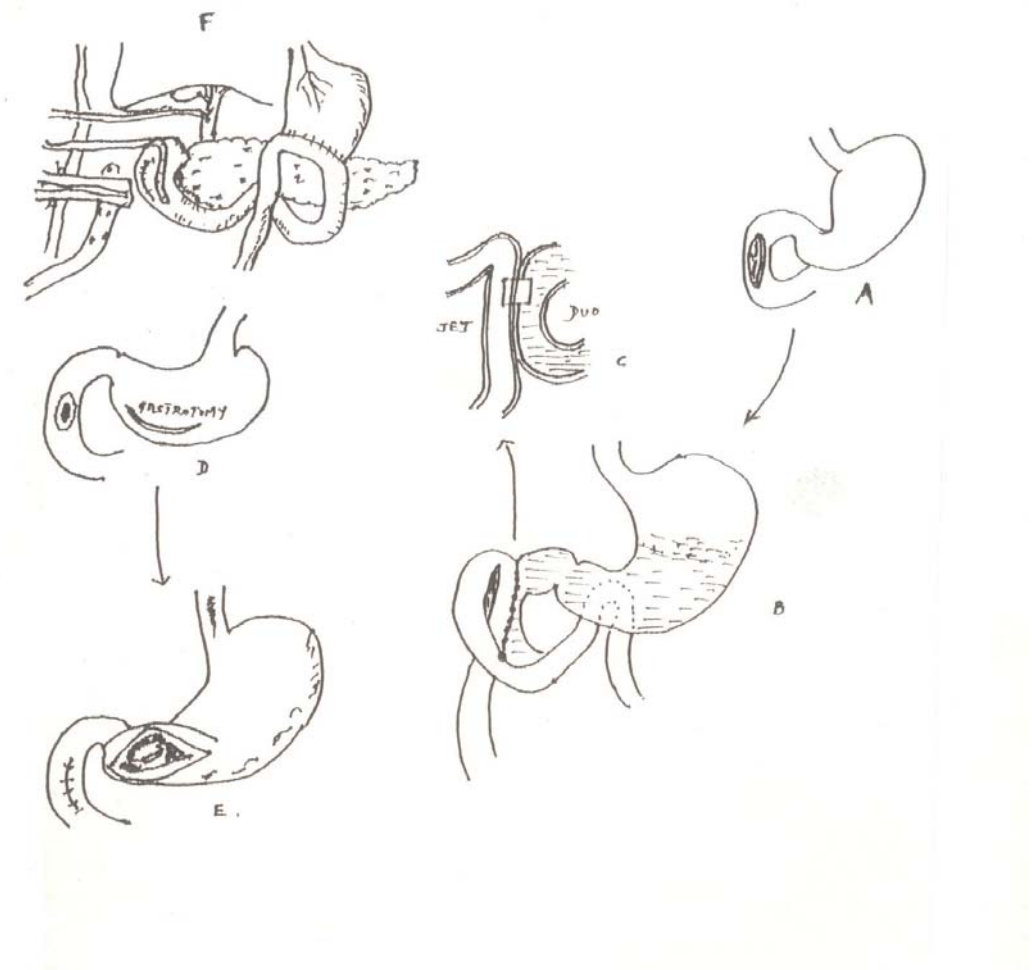
GASTRIC PERFORATION REPAIR
DUE TO STAB INJURY



COLON EXTERIORIZATION FOR DECOMPRESSION.

THIS PROCEDURE I S USUALLY ADOPTED FOR

CLASS III COLONIC INJURY AND RECTAL INJURY



SURGICAL PRINCIPLES AND MANAGEMENT OF COMPLEX DUODENAL INJURIES

A) Duodenal injury

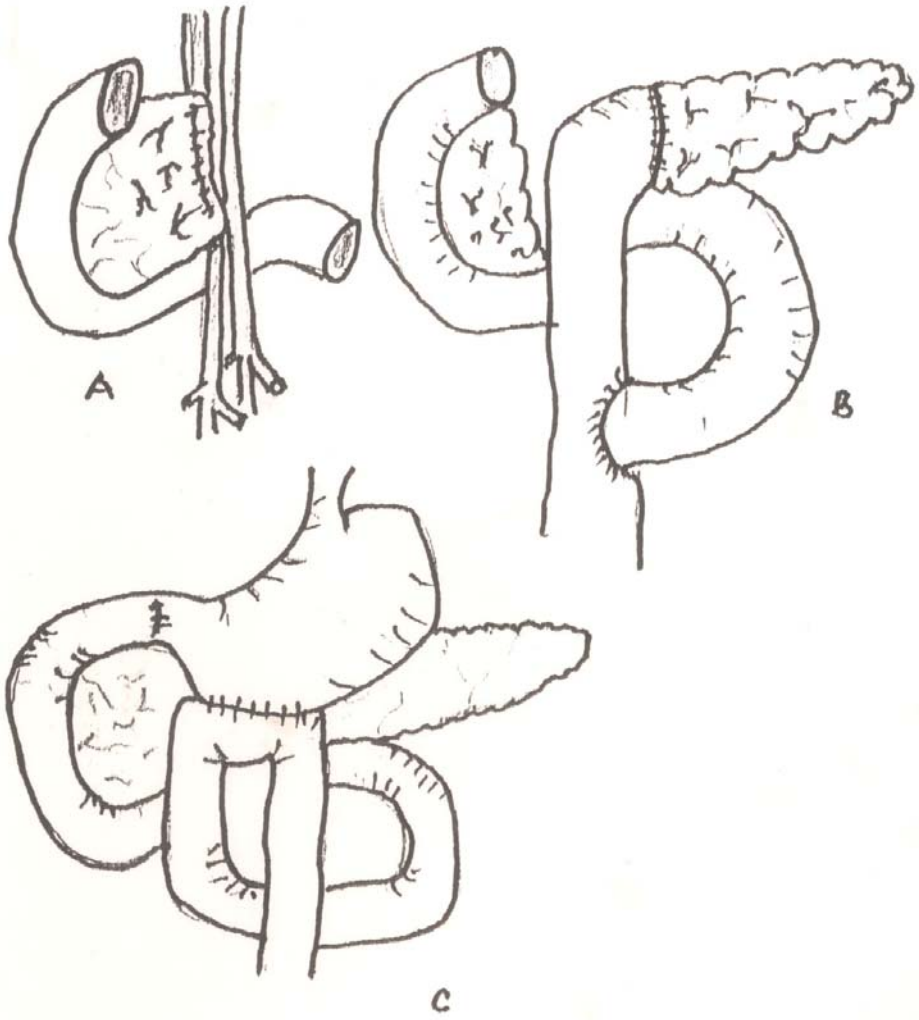
B) Serosal patch of jejunum

C) Principle of a serosal patch

D) Duodenal injury with gastrotomy

E) Pyloric Exclusion

F) Diverticulation with triple drainage



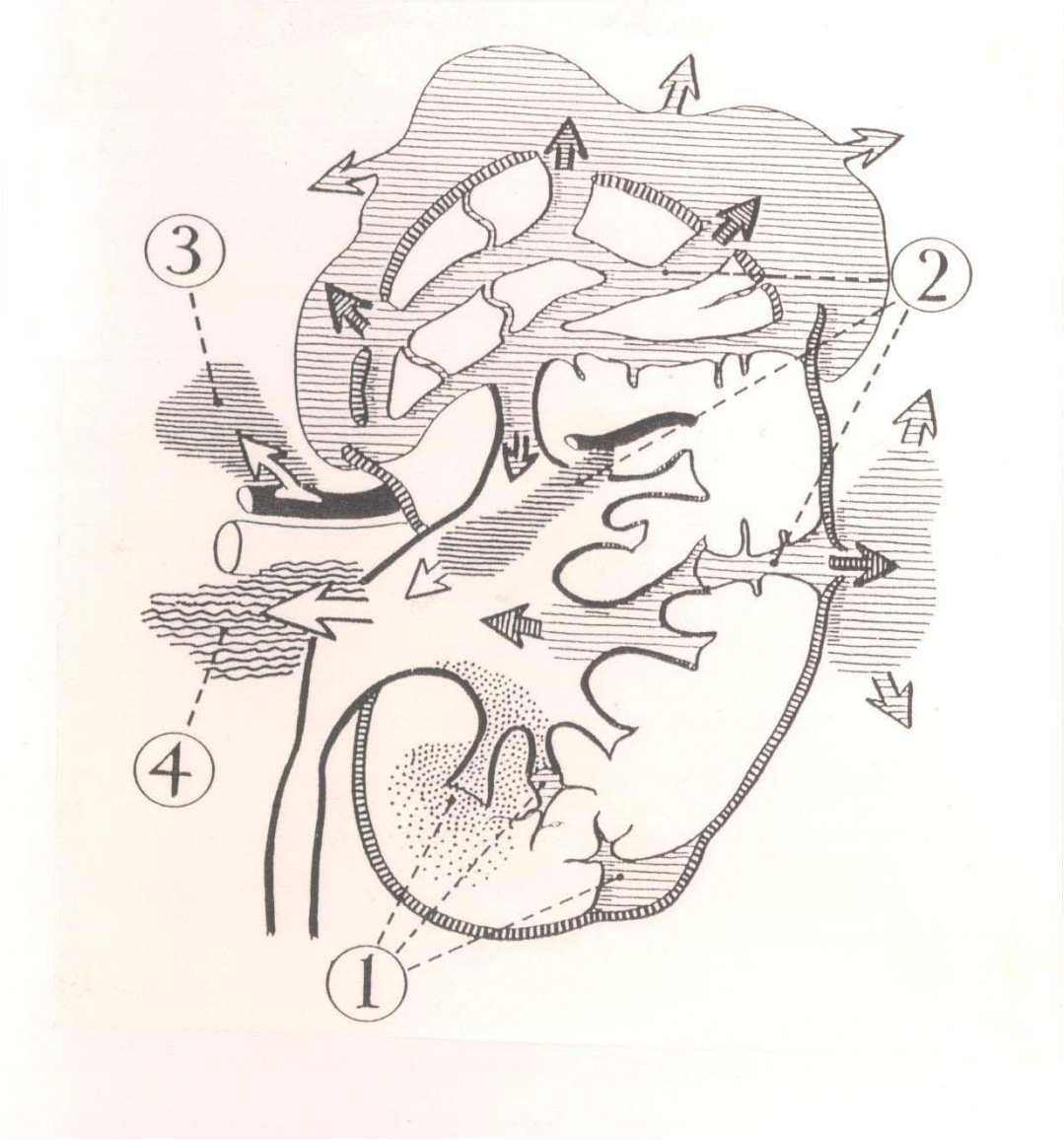
SURGERY FOR PANCREATIC INJURY

A) Distal pancreatectomy

B) Sub total pancreatectomy with distal Roux-en-y

Pancreatico jejunostoy

C) Pyloric Exclusion



MECHANISM OF RENAL INJURIES

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ABDOMINAL VISCERAL INJURIES

PROFORMA

NAME: AGE: SEX: I.P.NO.
WARD:
OCCUPATION:
SERIAL NO.
DATE OF ADMISSION: DATE OF SURGERY:
DATE OF DISCHARGE:

1. Mode of injury: Blunt a)
b)
c)

Penetrating a)
b)
c)

2. Whether under the influence of alcohol- YES / NO

3. Time of injury
Time of admission
Interval

4. Chief complaints:
History of Unconsciousness/ duration
Vomiting
Hematuria
Convulsions
ENT bleeding
Chest pain
Difficulty in breathing

5. Any significant medical illness like DM / TB / BA / IHD / COPD

6. General examination
Pallor
Dehydration
Pupils
Pulse rate
Volume of pulse
BP
RR
Glasgow coma scale

7. CVS

8. RS

9. a) Anterior abdominal wall
Bruises
Lacerations
Contusions

Penetrating wound

a) Number
b) Quadrant
c) Prolapse of omentum/bowel
d) Extending into thorax YES/NO
e) Surgical emphysema YES/NO

b) Abdomen

Tenderness	YES/NO
Distension	YES/NO
Guarding	YES/NO
Rigidity	YES /NO
Bowel sounds	YES / NO
Free fluid	YES /NO

Per rectal examination

c) External genitalia

a) penis
b) testis
c) blood in external urethral meatus

d) Pelvic bone fracture

e) Any significant chest wall injury

f) Spine

g) Long bone injuries

10.Clinical diagnosis

11.Investigations

Blood grouping / Rh typing
Hb%
Blood Glucose
Urea
Serum creatinine

Urine Albumin
Sugar
Deposits

X rays Chest AP
PA

Abdomen Erect AP Plain
Supine AP Plain

USG Abdomen
Pelvis

Four quadrant aspiration

Diagnostic peritoneal lavage

CT Scan Abdomen

IVP

Treatment

Conservative

Surgery

Operative findings

Post operative period

Further procedures & Follow-up